

Position Description

1. General Information

Name of the position	Advanced surface modified materials for Li-ion batteries
Foreseen enrolment date	1 October 2024
Position is funded by	<ul style="list-style-type: none"> • COFUND, Marie Skłodowska-Curie Actions (MSCA), Horizon Europe, European Union • Centre National de la Recherche Scientifique (CNRS) • The University of New South Wales (UNSW)
Research Host	Centre National de la Recherche Scientifique - Institut de Chimie de la Matière Condensée de Bordeaux (UMR5026)
PhD awarding institutions	Université de Bordeaux & The University of New South Wales
Locations	Primary: Pessac, France Secondary: Sydney, Australia
Supervisors	Cyril Aymonier and Laurence Croguennec (ICMCB, Bordeaux University) and Richard Tilley (UNSW)
Group of discipline	Supercritical Fluids, core-shell materials, advanced characterization, HRTEM, electrochemical energy storage, batteries, electrode-electrolyte interface, material sciences

2. Research topics (only one of these projects will be funded)

Project 1: *Advanced materials for Li-ion batteries and stabilized solid-solid electrode-electrolyte interfaces*

It is critical today to explore other strategies to increase the energy density delivered by Lithium-ion batteries and thus meet the ever-increasing needs of applications (transport, storage of renewable energies etc.) in terms of autonomy. All solid state batteries appear as the technologies of choice, by replacing the liquid electrolyte by a solid electrolyte and the graphite negative electrode by lithium metal. However, the challenges remain numerous, the main one being the control of chemical and mechanical properties at solid-solid interfaces.



This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement N° 101081465

The aim here is to use spinel type manganese-rich compounds at the positive electrode and to modify their surface by supercritical fluid chemical deposition process (SFCD). The objective of this project is to study, understand and control the deposition of different kinds of materials on the spinel type manganese-rich compounds. It will imply the investigation of the influence of the main parameters of the SFCD process through a deep characterization of the obtained materials, for instance by High Resolution Transmission Electron Microscopy (HRTEM).

The project will be performed in close collaboration between EMU at UNSW (Australia – Expert in HRTEM) and Idelam company (France – Expert in development of SFCD-based technology), and ICMCB at Bordeaux University (France - Expert in the development of electrode materials for batteries and supercritical fluids).

Supervisors: Cyril Aymonier and Laurence Croguennec (ICMCB, Bordeaux University); Richard Tilley (EMU, UNSW)

Research Fields: Supercritical Fluids, core-shell materials, advanced characterization, HRTEM, electrochemical energy storage, batteries, electrode-electrolyte interface, material sciences

Project 2: *Stabilization of electrode-electrolyte interfaces in Li-ion batteries*

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The aim here is to use spinel type manganese-rich compounds at the positive electrode and to study the stabilization of the electrode-electrolyte interfaces thanks to materials whose surface has been modified by supercritical fluid chemical deposition process (SFCD). The objective of this project is to study and understand the phenomena at the electrode-electrolyte interface with the new family of core-shell materials prepared by SFCD. It will imply, for instance, the investigation of this interface by High Resolution Transmission Electron Microscopy (HRTEM).

The project will be performed in close collaboration between EMU at UNSW (Australia – Expert in HRTEM) and Idelam company (France – Expert in development of SFCD-based technology), and ICMCB at Bordeaux University (France - Expert in the development of electrode materials for batteries and supercritical fluids).

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Project 3: *Performance of Li-ion batteries with a new generation of positive electrode materials*

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The aim here is to use spinel type manganese-rich compounds at the positive electrode coated by supercritical fluid chemical deposition process (SFCD). The objective of this project is to prepare the high energy density batteries, to study and to understand the evolution of the electrochemical properties as a function of the characteristics of the shell deposited at the surface of the spinel type manganese-rich compounds. It will imply, for instance, the postmortem investigation of the coating by High Resolution Transmission Electron Microscopy (HRTEM).



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3. Employment Benefits and Conditions

CNRS offers a 36-months full-time work contract (with the option to extend up to a maximum of 42 months). The total working hours per week is 38.5h.

The remuneration, in line with the European Commission rules for Marie Skłodowska-Curie grant holders, will consist of a gross annual salary EUR 27,000. Of this amount, the estimated net salary to be perceived by the Researcher is EUR 1,850 per month. However, the definite amount to be received by the Researcher is subject to national tax legislation.

Benefits include

- Becoming a Marie Skłodowska-Curie fellow and be invited to join the Marie Curie Alumni Association
- Access to all the necessary facilities and laboratories at Institut de Chimie de la Matière Condensée de Bordeaux (UMR5026) and UNSW
- Tuition fees exemption at both PhD awarding institutions
- Yearly travel allowance to cover flights and accommodation for participating in AUFRAANDE events
- 10,000 EUR allowance to cover flights and living expenses for up to 12 months in Australia
- 45 days paid holiday leave
- French Social security coverage
- Sick leave
- Parental leave
- Language classes (by University of Bordeaux)
- Other courses in transferable skills are proposed by University of Bordeaux and UNSW

4. PhD enrolment

Successful candidates for this position will be enrolled by the following institutions and must comply with their specific entry requirements, in addition to AUFRAANDE's conditions.

Applicants must hold a Master degree in chemistry, physics or a related field or an equivalent qualification awarded following a training course with a substantial research component and demonstrated capacity for timely completion of a high-quality research thesis.



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Applicants must demonstrate an English language proficiency equivalent to an overall IELTS score above 6.5 and no band below 6. Note that the test needs to be completed no more than two years before enrolment. For more information about the tests accepted and scores required, visit:

<https://www.unsw.edu.au/study/how-to-apply/english-language-requirements>

More information on Université de Bordeaux' requirements

Visit the website: <https://college-doctoral.u-bordeaux.fr/en/Graduate-Research-School/The-Doctoral-Schools/Chemical-sciences>

More information on UNSW' requirements

Visit the website: <https://research.unsw.edu.au/higher-degree-research-programs>



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